Seats and their anchorages' strength in coaches under rollover

T. Vicente Corral[(1)] , F. Aparicio Izquierdo[(2)], B. Valles Fernández[(3)]

(1) INSIA-UPM (Instituto Universitario de Investigación del Automóvil), Ctra. de Valencia km7, 28031, Madrid. 913365308 teresa.vicente@upm.es

Keywords: safety belts' anchorages, seats, rollover, coaches, safety, requirements, tests, structural strength

Abstract:

The introduction of safety belts in the passengers' seats of coaches could have important repercussions increasing their safety under frontal impact and rollover.

This type of vehicles has a particularity from cars or trucks: the safety belts are fixed directly to the seats and not to the vehicle structures. A lot of work has been made in Europe (and it is being made) to define requirements for seats, seats' anchorages, restraint systems and safety belts' anchorages to guarantee the correct retention of the passengers in their seats under frontal impacts.

In case of rollover, the belted passengers increase the energy that must be absorbed by the superstructure because some of their mass must be considered us rigidly joined to the vehicle. This situation has been taking into account in the current European legislation (Regulation UN-ECE 66, Revision 01). This version of the Regulation has increased the requirements for the superstructure to assure that the behaviour of the superstructure is as good as in the vehicles without belted passengers preserving the survival space. This new revision is going to be mandatory for new types from October 2010 (and for new matriculations from October 2017), but a considerable number of coaches' manufactures are modifying their structures under this new revision because they take in mind that if the safety belts are yet included in the coaches, the superstructure must be in accordance. This is an important effort of redesign: more resistant structures but without weight increase.

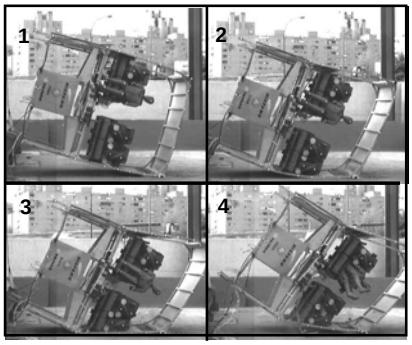

Fig 1. Ej. Rollover with restrained passengers.

So, we have requirements for the seats under frontal impact and for the structure under rollover… What happen with seats and restraint systems? Nowadays there is nothing in regulation about the seats, their anchorages or the safety belts' anchorages to assure a correct passengers' retention under rollover

This paper presents the research carried out by INSIA-UPM to analyze this item. The lateral strength of seats and their anchorages (including safety belts) has been analyzed under two points of view:

- As a correct restraint system for the occupant in case of rollover, supporting two types of efforts without broken or excessive deformation: from the structure due to the deformation and from the restrained passengers through the safety belts' anchorages.

- As a component to be taken into account in the energy absorption capability of the whole superstructure in case of rollover.

Fig 2. Lateral strength tests.

First of all, the mechanism of deformation of these components under rollover has been defined, estimating the loads that could be transmitted by the restrained occupant. Some tests have been defined and some current seats has been tested to characterize them and to determine if it could be necessary to establish new requirements to guarantee the correct retention of the coaches' occupants in a rollover accident.

Main contributions.

Structural requirements for coaches' seats under rollover and a new verification methodology, experimental data of current seats, proposals to improve the design in order to contribute to the structural absorption capabilities of the whole vehicle